The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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The Generation of Power

FUEL problems are of considerable importance to the chemical industry, if only because some branches of the industry, essentially the electro-chemical methods of manufacture, depend for their feasibility upon cheap power, or, more specifically, on the ratio of the cost of fuel and power in any process to the cost of the finished product. In calcium carbide manufacture, for instance, it is interesting to note that not long ago the power requirements for the process were 4000-4500 kWh., whereas the most recent furnaces upon which information has been published require only 3000 kWh. per ton of carbide. Shortly before the war the price of carbide was about £18 a ton, and it can readily be seen that if the price of power were 1d. a unit the cost of power would have been in the neighbourhood of £18 a ton for older plants and £12 10s. a ton for recent plants.

A recent American paper by N. E. Funk has shown how the cost of power has been reduced progressively during the present century. The Philadelphia Electric Co. has, for example, found that in its own plants the coal required per kWh. has been reduced from 6 lb. in 1942 to 4 lb. in 1910, 2 lb. in 1920, and for the last 8 years has been fairly steady at 1 lb. That the coal cost per kWh. has only been divided by 3.5 during that period is because of the progressive rise in the cost price of coal. It is thus evident that to obtain low cost of power for a coal-fired station it is necessary to have the most efficient plant, and also to make use of the cheapest variety of coal.

Improvements in power-generating plant have been due to the development of alloy steels and to advances in the art of welding, which between them have enabled knowledge which was previously academic to be put to practical use. The importance of this fact is that in large plants much higher pressures and temperatures can now be used so that the previously existing low-pressure plant can now be used as a second stage, the first stage being a high-pressure high-temperature turbo-generator. Present materials used in the first stage of these plants may be suitable for temperature conditions as high as 550° C., though the range at which they are being used is now between 480° and 510° C. Carbon-molybdenum steels have been used for most applications, though chromium, and sometimes nickel-chromium, steels are required for special uses. It is evident that under these conditions, in which the steam is practically red-hot, bolted and flanged joints are not feasible, and it is only by the improvements in the art of welding that advancement have become possible. To prevent operating difficulties from distortion and expansion, Mr. Funk points out that it is desirable to reduce the amounts of material in contact with high pressure and temperature to a minimum. This requires turbine speeds of 3600 r.p.m. in place of the 1800 r.p.m. machines that were in general use for the lower pressure range. This, again, has required advances in metallurgy before it became possible.

Another interesting adjunct to high efficiency is the cooling of these high-speed generators by hydrogen. The relatively high specific heat of hydrogen per unit of weight no doubt suggested this practice, which was introduced in 1928. Hydrogen of high purity, never below 90 per cent., is necessary, from the standpoint both of safety and economy. The advantages of hydrogen are thus summarised by Funk: (1) Windage and ventilation losses in hydrogen are only about one-tenth of their value in air, owing to the lower density of hydrogen. (2) The rating of a machine can be increased approximately 20 per cent. for a given amount of active material, by operation in hydrogen instead of air, because of the superior cooling properties of hydrogen. (3) The life of the winding insulation is increased, owing to the absence of moisture, oxygen, and dirt, and to the fact that corona damage is eliminated in the hydrogen-cooled machines.

An interesting development, doubtless not feasible in this country, but already utilised in certain foreign lands, notably Russia, is the generation of power from wind. Whereas utilisation of water power has already reached a high degree of development, the wind wheel suitable for the production of great quantities of energy is an innovation. In East Africa, for example, in the zone of the very uniform monsoon winds, by using such a method of power-production, 12,500 kWh. yearly may well be achieved with a generator of 50 kW. output, at a total maximum cost of ¾d. per kWh. In Russia it is intended to develop wind motors for farming on a great scale; it is recorded that a motor developed specially for the purpose, which generates 6.5 h.p. with a wind velocity of 8 metres a second and 25 metres a minute, will produce a year with an average wind velocity of 4 m./sec. 9450 kWh., with 5 m./sec. 15,000 kWh., and with 6 m./sec. 21,000 kWh. The cost of operation is such that even at an average wind velocity as low as 4 m./sec. the plant is said to work more economically than a petrol engine. Provision must be made in many industries for alternative methods of power production during calms or for battery storage on a large scale. In America there is a generator built by the General Electric Company rated at 1000 kW. in which energy is raised to 44 kV. for transmission

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into a public service system over a 4-mile transmission line. At this station records show that favourable wind will be available to operate the unit for about 1000 hours a year, about 2700 of which will be at full load. Thus the unit would be put into service at a small percentage of rated capacity when the wind reaches a velocity of 18 m.p.h. and will be taken out of service at wind velocity above 60 m.p.h. The control of the station will be entirely automatic, using very much the same equipment as in automatic hydro-electric plants. Although this is a generator of considerable size it is intended to be experimental.

These particulars, though of no immediate interest to the chemical industry of this country, may yet be of value to chemical firms proposing to erect works overseas, where coal or other normal fuels are expensive owing to high transport costs. It will be seen that the persistence and velocity of the wind have a good deal to do with the possibilities of successfully manufacturing power by this means, and that wind power is still far from being a serious competitor of water power for low-cost chemical manufacture.

NOTES AND COMMENTS

Tin Shortage and Lacquer Research

NO one, we imagine, will raise objections to the spate of official orders controlling rubber and tin which the presses of H.M. Stationery Office have been turning out recently in such numbers as to threaten yet another order controlling and restricting paper. Such a repercussion was to be expected after the Japanese advance along the whole length of the Malay Peninsula. Something like 80 per cent. of the world's rubber and 40 per cent. of the world's tin ore were produced in the Peninsula, with the Netherlands East Indies a good second in both cases; Siamese tin production, too, it must be remembered, was about one-fifth of that of Malaya. The most important and immediate outcome of all this is the necessity for providing substitutes to make up for the inevitable shortage of these commodities. The chemistry of rubber substitutes has been discussed almost *ad nauseam*, partly because that branch of industrial chemistry has long been the pride of the well advertised German chemical industry. The replacement of tin is another matter; and the ingenuity of industrial research chemists should find plenty of scope in solving this problem. It has been known for some time that the Germans have been using lacquer coatings for the production of " untinned tinplate," to be used for food-containers, etc Certain chemical products, it will be found, will attack the film of lacquer with which the sheet steel is coated to produce this material, and the development of specially resistant lacquers is envisaged. It is made clear in recent orders, however, that where no lacquer at present available will stand up to the attack of a chemical product, it is possible that a small allocation of tinplate can be made for packaging, provided that a " cast iron " case can be made out.

Rubber—Reclaimed and Synthetic

A HEATED debate on the rubber question arose in the House of Commons this week, when Mr. Parker, the Labour Member for Romford, indicted the Ministry of Supply and the Rubber Control for " criminal negligence." He alleged that the " big tyre and plantation interests " had done all they could to discourage the rubber-reclaiming industry, even since the possibility of a Japanese attack on Malaya came into the picture. He further alleged that even after real control of rubber was introduced on December 12, a great deal of rubber had been used by the big firms for the manufacture of articles valueless from the national standpoint, and that much scrap rubber had been burned. Mr. Hewlett, Conservative (Manchester Exchange), defended the Rubber Control and accused some of the firms, who had shouted the loudest for reclaiming facilities, of exporting scrap rubber to Germany at a time when it suited their pockets. He suggested that priority in man-power and repair facilities should be granted forthwith to the reclaimed-rubber factories. Mr. Harold Macmillan expressed the Government's view and noted that crude rubber before the war was sold here at so low a price that a purely economic reclaiming industry could not exist. The Government was trying to operate the Rubber Control under men of the highest repute who had a long association with the rubber industry. One piece of really good news that Mr. Macmillan offered the House was that an arrangement had been made between the British Government and the United States by which the development of the manufacture of synthetic rubber in the United States would be an immense scale. As he said, it was doubtless best to do that in the place where the necessary raw materials were available.

LETTER TO THE EDITOR

Recovery of Used Lubricating Oil

SIR,—Considerable interest has been displayed, in THE CHEMICAL AGE and elsewhere, on methods for the recovery of used lubricating oils and the reconditioning of insulating oils. Contact treatment with activated clays and earths is now a well-known process. We should like to bring to the attention of oil users the possibilities of employing activated alumina as a physical and chemical purifying agent for the reconditioning of used oils.

Activated alumina is now prepared and marketed in this country and its use in oil treatment is one of its important war-time applications. The best way of using this material is by the method of percolation, when a size grade of 16-32 mesh would be best in small units and larger grades for the bigger units. Activated alumina has a very high capacity for adsorption of water, of acids, organic and inorganic, of coloured substances, sulphur compounds, and so on, and has the particular advantage of being a standardised product. Its greatest advantage over the activated clays and earths is that it can be reactivated repeatedly. The activated alumina is regenerated by heating to 200-250° C. under slight pressure reduction or in a current of hot gas. The adsorbed substances are then removed by combustion and volatilisation and the alumina after cooling is ready for use again.

In the treatment of transformer oils the great advantages which this process possesses over the ordinary filtration method of removing sludge and water are that the acidity can be controlled and that the dielectric value is restored to that of the original oil. If the acidity of the oil is low it suffices to pass the oil through a tube of activated alumina. If the oil has a high acidity value and contains much sludge, it is much more economical first to remove water and sludge in a centrifuge or blotting-paper press, and then decrease the acid value with activated alumina. In this way the alumina retains its efficiency for a longer period before needing reactivation. The oil should be in contact with the alumina for a period of time varying with the degree of acidity of the oil, since the process is essentially one of physical adsorption. Apparatus for attachment to transformer units and reactivation plant have been described recently by Housley (*Electrical Engineering Trans.*, 1939, p. 172).

It is our opinion that the installation of simple units employing activated alumina can effect a considerable economy in the usage of lubricating and transfer oils and that the initial cost of the alumina reactivating unit is amply offset by the saving it effects in adsorbing material.—Yours faithfully,

Widnes, January 30, 1942.

J. HARWOOD.
W. CULE DAVIES.

Production of scheelite concentrates in New Zealand is on the increase, despite the difficulties caused by the erratic distribution of the mineral. Figures so far available show that output increased from 41 tons in 1939 to 74 tons in 1940, all of which was sold to the Imperial Government.

Zinc Carbonate Ores

Improved Methods of Calcination

by A. G. AREND

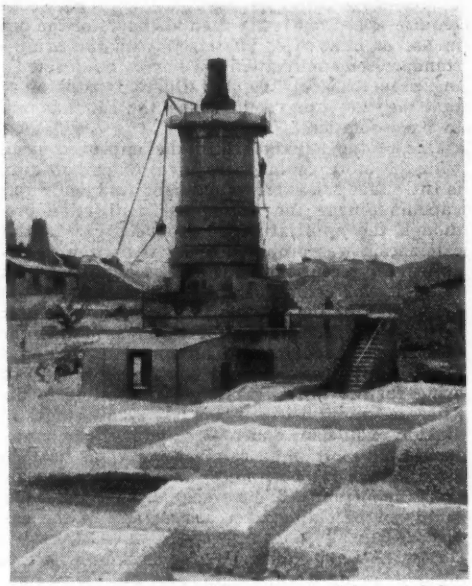
IMPROVEMENTS in the calcination of zinc carbonate ores have been of somewhat slight account until comparatively recently, since the large tonnage usually accommodated in the earlier types of calcining hearths were regarded as sufficient for all ordinary requirements. The most usual zinc carbonate ores are calamine or zinc spar, and the rather less frequent zinc bloom, which is a combination of hydrate and carbonate; inferior grades are found in combination with dolomite, calcium carbonate, etc. Although calamine formerly represented the chief source of zinc ore, the purer deposits have slowly become exhausted, and a much cruder class of ore is nowadays treated. The earlier method of calcining the carbonate economically in shaft furnaces, with a small consumption of fuel, has therefore had to be revised in keeping with the lower content of zinc now recoverable. Shaft furnaces have always been much cheaper to handle than the corresponding reverberatory hearths, and could be used to work lumps of ore directly as received from the deposit.

Reverberatory calcining furnaces can compete only when well constructed and accurately controlled, and are more or less limited to dealing with broken, or at least partly reduced, lumps. Although reverberatory hearths have been used in this country to some extent, unless use can be made of the waste heat (for warming the air employed for combustion), the costs have become unduly high. The chief criticism of the shaft type of hearth was that the ashes of the fuel could contaminate the burnt ore, while at times the temperatures appeared to be beyond control, resulting in the reduction of a certain amount of the zinc. Recent improvements, in short detail, consist of introducing the producer-gas type of firing, together with systematic control of the temperature at the different stages. Researches conducted on these hearths revealed that as much as 20 per cent. of fines could be successfully included in the charges, without interfering with the evolution of carbon dioxide, so that there was no need for a supplementary reverberatory hearth to complete the calcination of the total output. In other words, the improved design of hearth was satisfactory for calcining all material from the zinc mine.

Although pure calamine is understood to contain some 52 per cent. of zinc, the impurities found in practice in many of the deposits to-day reduce this to about 40 per cent., and mixed ores may be very much poorer, yet still worth working. As poor ores, particularly of the carbonate variety, were the subject of intensive research with a view to providing a suitable electrolytic extraction process, particularly as they were of a more or less soluble nature, makers of calcining furnaces for some time were apparently afraid to introduce any sweeping advances, and were content to follow lines already established. As years elapsed, however, statistics soon revealed that, despite the claims made for the electrolytic process, the total tonnage thus provided did not exceed about one-fifth of the total, and further showed little prospect of changing. The U.S. Bureau of Mines statistics for 1927 showed a total zinc production of 592,516 tons of smelted zinc, and 112,629 tons of electrolytic zinc, while in 1936, the totals respectively were 491,800 tons and 126,600 tons. Interest naturally returned to improving the existing smelting process by perfecting the initial calcining system.

Manipulating the Improved Calciner

To begin with, the lumps of ore are handled in the most expeditious manner, and instead of the earlier hand-driven bogies, or slow-moving skips, use is made of the electric current available to run complete train-loads of the material to the calcining hearth. Electric cars are linked up to sets of trucks containing the lumps which are conveyed to the site of the furnace, and dumped in the form of large built-up squares of ore. This meets the requirements of the modern calciner which handles a large tonnage at a time. In appearance, the calciner in some respects resembles a blast-furnace, as it is a tall vertical cylindrical contruction, surrounded by a steel shell, and charged by a bell-mouth arrangement at the top. The producer which supplies the gas is built in a shed adjoining the furnace, as a separate unit. The gas enters portholes at different points, in order to provide the heat in such a way that all carbon dioxide and water are completely expelled. Tests are made at each of these points by the attendant to ascertain the volume, flow, and percentage of carbon monoxide in the gas, and the temperature produced, while this is later checked by the tonnage of calcined ore obtained per 24-hour day. The temperature applied must not only break up the ore to zinc oxide and carbon dioxide, but also be sufficient to decompose any other foreign carbonates that may be present. Whereas zinc carbonate is comparatively readily calcined, the work becomes much more complicated where calcium carbonate, and particularly barium carbonate, are also present.



The improved type of furnace used for calcining zinc carbonate ores

The former requires bright redness for decomposition, whilst barium carbonate cannot be properly decomposed, even at a white heat. This latter fact was revealed by studying the methods employed for decomposing witherite, where the addition of carbon was found necessary, as heat alone could not be depended upon to remove the carbon dioxide completely. Before the producer firing had been introduced, it was not uncommon practice to find so-called calcined ores which still contained some 17 per cent. of carbon dioxide.

Electric Traction for Ore Transport

One of the chief practical difficulties when dealing with poorer and impure zinc carbonate ores, is that while the burnt material may attract carbon dioxide from the atmosphere, because of the exposure of zinc oxide, this tendency becomes much more extreme where lime also is exposed. Accordingly, unless the retorts are at hand to distil the calcined ore more or less directly, much of the work may be undone. For this reason, as it is not always possible to erect distillation furnaces in immediate proximity to the calciner, and as comparatively large tonnages are handled at a time, advantage is again taken of the system of operating electric cars. As each load of calcined ore is discharged, it passes into a cooling shaft, and thence is led into trucks through a hopper device, after which it is directly transported to the retort battery. Without the necessary electric current, the foregoing system could not

be economically operated, since steam locomotives would require to be kept ready fired all hours of the day, whether in use or otherwise. Similarly, with the firing conditions standardised, most attention has to be devoted to arranging proper spacing for the different loads of raw ore, so that they are ranged all round the calciner, and charged in fixed rotation.

One of the advantages of the improved system is that with the more complete removal of carbon dioxide, there is little that can exert an oxidising influence upon the zinc vapours during the subsequent distillation process. Although the application of producer gas to this form of calcination was proposed many years ago, it is only comparatively recently that it has been put into practice, because it was erroneously contended that the gases at the final stage of the process might cause a re-absorption of carbon dioxide. It was for this reason that the calcined mass was passed into an intermediate cooling shaft in a neutral atmosphere before being removed. Producer-gas firing further proved that it was possible to discriminate with accuracy between the different stages of carbon dioxide expulsion, and apply the exact amount of heat to ensure the most rapid calcination. This heat is varied at the different gas port-holes, and the expelled gas is given every opportunity to be freely discharged, a point which could not be claimed for almost any of the earlier shaft furnaces.

Despite every effort to get some appropriate use for the large amount of carbon dioxide expelled, such as compressing it into cylinders, etc., it has to be admitted that up to the present it is allowed to pass off to the atmosphere, but there is little doubt that had the work been in the vicinity of chemical factories, instead of in remote mining localities, it would have been turned to useful account.

Economics of the Process

As regards fuel consumption, earlier figures reveal that this varied between 3 and 6 per cent. of the weight of raw ore calcined, and by special manipulation of the layers of fuel and ore, could be regularly reduced below 4 per cent. Despite various alterations in the dimensions, this figure could not be bettered, but with the advent of the latest producer-fired furnace, the total fuel consumption rarely reached 2 per cent., even although the charge contained much fines, which were known to slow down the calcination.

Whereas with the ordinary shaft hearths great care has to be taken in the selection of the fuel, so that little ash will contaminate the charge, no such difficulties exist with producer firing. Apart from coal, it is stated that the Dutch system of utilising sawdust is taken advantage of, where wood abounds near the mining district. This means that the costs of firing are little more than labour and furnace depreciation, and as native labour is employed, the total cost is trifling as compared with ordinary European practice. Volatilisation of zinc is literally unknown, while wear of the refractories is reduced to a minimum, since excessive temperatures need not be applied. The hottest zone of the hearth is purposely made of refractory blocks which can be readily replaced, by removing and returning a narrower part of the shell. Unlike the charging of blast-furnaces, which requires different mechanically operated devices, the continuous nature of the work makes it possible simply to introduce the charge at the bell-mouth top with the assistance of a light crane-arrangement. One capacious bucket of ore is simply drawn up and charged within a fixed number of minutes.

Conditions Inside the Furnace

Regarding the refractory lining, this consists of selected clay fire-brick in the form of blocks and bricks of known porosity. The air for combustion is purposely heated by leading it around a form of flue before mixing it with the producer gas, as highest yields can thus be obtained. It should be added that fuel consumption is also influenced to no small extent by the amount and quality of the impurities present; as a general rule, the fewer the impurities, the less is the gas consumption. Certain silicates present were known to affect the lining, and were understood to be picked out manually prior to charging. The same silicates also add to subsequent crushing difficulties, as they are often very hard, and tend to damage the edge-runners, or other reduction plant used. When the mass is discharged, it is reduced in the crusher, but not to the fine extent previously required by the Belgian distillation process. Impurities that may be present include iron, manganese, copper, lead, bismuth, and cadmium, apart from the alkaline earth metals, and the actual process of distillation has been but little varied.

A certain amount of interest has arisen over attempts to revive the uninterrupted distillation process which had been unsuccessfully tried out some twenty years ago. The furnace used consists of an improved design of electric radiating hearth. Details of the hearth and process appeared in German Patents 148,439, 157,603, 162,535, and 158,545. Whether or not this system has succeeded, there have been no reports of its economic results, so that it is difficult to arrive at a conclusion, and in present circumstances it is not likely that it will receive official recognition.

Oppanol in Germany

Applications in Chemical Engineering

OPPANOL, the polymerisation product of *iso*butylene made by I.G. Farbenindustrie, is now being used mainly in conjunction with various fillers for chemical and engineering purposes where its resistance to acids, alkalies and organic materials is of advantage. Oppanol foils are employed for construction purposes as a protection against subsoil water. ORG foils (*i.e.*, Oppanol foils with suitable fillers) are used for the same purpose and by chemical apparatus makers, although their mechanical strength does not equal that of polyvinyl chloride foils. For fixing these foils on metal or wood cold glues are employed, but for use in connection with concrete special adhesives have been developed. Seams are welded under pressure at temperatures of, about 300° C., usually with special welding equipment. ORG hoses are used to protect metal, wood, and concrete pipes. They are reported to give adequate service at temperatures between −50° and + 100° (in special cases 130°) C. and are cheaper than lead and rubber coverings.

New Paper from Old

Salvage and Modern Power in Combination

HOW our national stock of paper is being replenished by the salvage of waste is strikingly demonstrated by the increase in output, due to electrical conversion, of a paper mill in Wales at present mainly employed on specialities for Royal Ordnance factories. One of its chief activities is the turning of salvaged waste into speciality paper mainly used in detonator tubes, flare tubes, and shell component parts.

The mill began working about 1750 and at that time was driven by hand power. Subsequently machinery driven by a water-wheel was installed and this in turn was replaced by a gas engine. The final change took place within the last six years when a Crompton 175 h.p. auto-synchronous electric motor was installed. This motor drives the main shaft of the mill by means of a V-flat rope drive, and keeps the overall power factor close to unity. Other electrical equipment was also supplied by Crompton Parkinson, Ltd.

THE IODINE EDUCATIONAL BUREAU, Stone House, Bishopsgate, E.C.2, has admirably succeeded in maintaining the high standard of its publication "Iodine Facts." Altogether 41 new facts (Nos. 102 to 143) have been brought together in the latest issue, the articles including, "Special Purpose Gas Masks," "Protection Against Mercury Vapour," "Iodised Fruit Wrappers," "Scavenging Steel," "Annealing in Iodine Vapour," etc. There is also an alphabetical index.

Metallurgical Section

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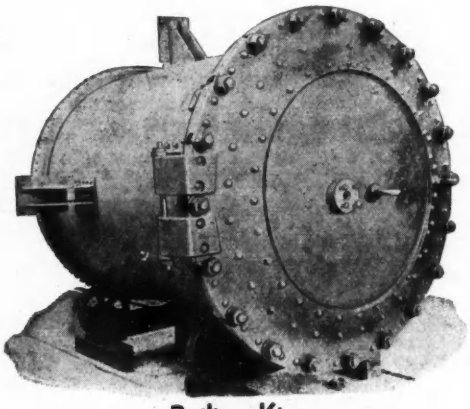

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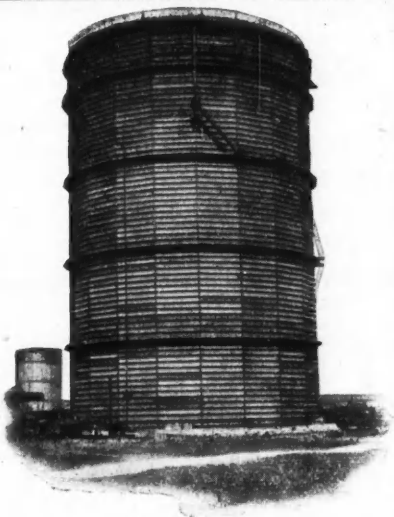

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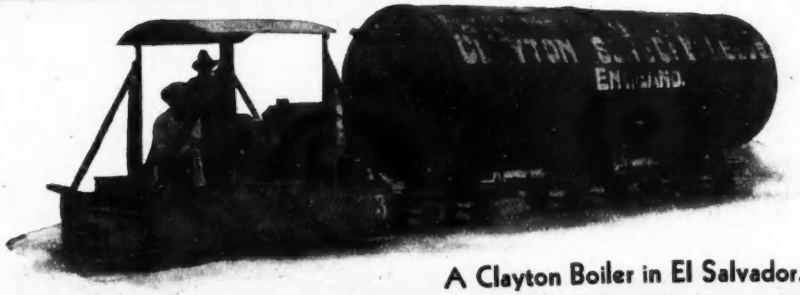

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Metallurgical Section

February 7, 1942

Metal Pickling with Ferric Sulphate*

Treatment of Stainless Steel and Copper Alloys

DURING the past few years the use of ferric sulphate for metal pickling has steadily grown. It is being increasingly adopted in place of such agents as nitric acid for stainless steel pickling and sodium bichromate for copper alloys. Their replacement by a chemical which is more abundant and less vital and at the same time conserves valuable alloys becomes of increasing interest.

In the manufacture of stainless steel and copper alloy sheets, tubes, and wire, the metal must be rolled or annealed at high temperatures with the consequent formation of a surface oxide scale or film. This has to be removed before further fabrication, and when it is done chemically, the process is called "pickling." The term is applied also to etching of ordinary steel and generally to any chemical treatment of metal for the purpose of altering its surface by attack.

Prior to the advent of ferric sulphate, the chemical baths commonly used for pickling sulphuric acid, hydrochloric acid, or a solution of nitric and hydrofluoric acids for stainless steels; sulphuric acid, a solution of sulphuric acid, nitric acid, and hydrochloric acids, or a solution of sulphuric acid and sodium bichromate for copper alloys; and the common mineral acids for ordinary steels. All these pickling baths have two characteristics in common. Each contains an acid which acts as a solvent for oxide scale, and an oxidising agent which changes lower oxides to higher more soluble oxides and usually dissolves some of the metal as well. The oxidising agent in the baths mentioned is hydrogen ion, nitrate ion, or bichromate ion.

Ferric sulphate solutions also possess these two properties. They are acid by hydrolysis and may be mixed with extra acid if necessary, and the ferric ion is an oxidising agent between hydrogen ion and nitrate ion in potential.

The various applications described below show that ferric sulphate answers the requirements of a pickling agent in practice as well as in theory, and that it offers a number of advantages over the other agents. The method of application varies with the result desired. For descaling, ferric sulphate may have additional acid added, such as hydrofluoric for stainless steel or sulphuric for copper alloys. For copper alloy brightening, small amounts of certain organic acids may be added; for etching ordinary steel no additional acid is normally required.

Baths for Stainless Steel

For pickling stainless steel, ferric sulphate replaces nitric acid in the customary nitric and hydrofluoric acid bath. The continuous black scale produced on the cold-rolled sheet in an oxidising muffle furnace is only slowly attacked by the sulphuric acid, but is removed equally well in the nitric-hydrofluoric and in the ferric sulphate-hydrofluoric baths. However, the ferric sulphate bath has the advantage of producing a brighter and shinier finish.

Fig. 1 shows the rate of attack of the three solutions on a heavily scaled steel. The nitric-hydrofluoric acid solution attacks the metal at a very high rate after the scale is removed, whereas at the same point the action of the ferric sulphate-hydrofluoric acid bath soon stops. In practical batch operation this is a real advantage since in many mills it is not possible to control the time of pickling accurately enough to obtain low attack with nitric and hydrofluoric acids; hence large amounts of alloy and chemicals are unnecessarily lost. With ferric sulphate and hydrofluoric acid there is no such danger of loss. For a mill with a 15-minute pickle cycle, nine times more alloy is lost with the nitric-hydrofluoric acid bath than with the ferric sulphate-hydrofluoric acid bath.

Another desirable feature of the ferric ion bath is the marked decrease in fumes. The steaming hot nitric-hydrofluoric acid bath is unpleasant enough itself, but during pickling, acid spray and oxides of nitrogen are

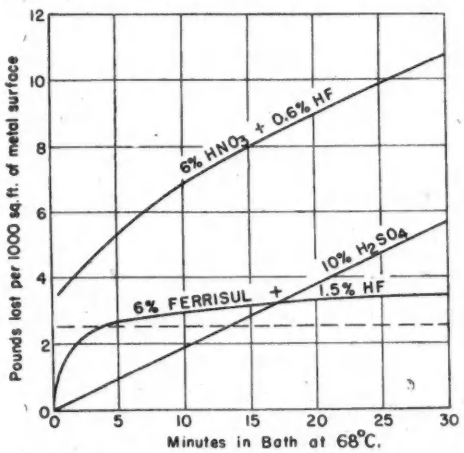

Fig. 1. Rate of attack of typical pickling solutions on cold-rolled annealed 18-8 stainless steel. The dotted line indicates the weight of the scale

copiously evolved so that the bath becomes hazardous to the health of all who work near it. On the other hand, no gas is evolved from a properly functioning ferric ion bath, and even the fumes are practically negligible owing to the formation of un-ionised ferric fluoride which greatly reduces the volatility of and danger from the hydrofluoric acid.

When ferric sulphate and hydrofluoric acid are mixed in proportions to form FeF_3 according to the equation,

$$Fe_2(SO_4)_3 + 6HF \rightleftharpoons 3H_2SO_4 + 2[FeF_3]$$

the characteristic brown colour of ferric ion is completely removed, and a water-white solution results. Thus in such a solution, hydrofluoric acid as such no longer exists in appreciable quantities and the danger usually associated with its use has been eliminated. In fact, the hand may be dipped in the bath without danger. Furthermore, it is necessary to add hydrofluoric acid to the ferric sulphate bath far less frequently than when pickling with nitric acid.

It is significant that satisfactory pickling usually occurs in solutions containing ferric sulphate and hydrogen fluoride in approximately the proportions indicated in the above equation (3.33 to 1 part by weight). Operating proportions for ordinary oxidised 18-8 are in the range of 3-6 parts of ferric sulphate to 1 part of hydrogen fluoride. The effect of a higher hydrogen fluoride concentration is to cause excessive attacks, while excess ferric sulphate

* From an article by John O. Percival, Colver P. Dyer, and Maurice H. Taylor (Merrimac Division of Monsanto Chemical Co., Everett, Mass.) in *Ind. Eng. Chem.*, 1941, *33*, 12, p.1529.

usually slows the scale-removing process. Operating concentrations are ordinarily 1 or 2 per cent. of hydrogen fluoride with proportionate amounts of ferric sulphate; the ratio of the chemicals to each other is more important than their actual concentration. The temperature used is commonly 70° C., and the time of pickling will vary from a very few minutes for light scales to an hour for exceedingly heavy scales. Both hot- and cold-rolled alloys are pickled satisfactorily.

During the period of commercial testing it was sometimes found that a red film deposited on the alloy. The film itself is of no consequence since it is easily washed off, but its appearance was usually associated with a higher rate of attack. The formation of this red film was in every case found to be an indication that the ratio of ferric sulphate to hydrogen fluoride had been allowed to fall too low, and addition of ferric sulphate to the bath corrected this condition.

Experience shows that rigid analytical control is not necessary. It is desirable at first, but operators soon learn to keep the bath in proper ratio range by observation of results or by an empirical scheme such as adding a shovelful of ferric sulphate after a definite amount of steel has been pickled.

It is sometimes found desirable to use a proportion of ferric sulphate to hydrogen fluoride outside the range mentioned above. For example, steels which have been annealed in a reducing atmosphere have strongly reducing scales and so consume more oxidising agent than those annealed in an oxidising atmosphere, probably on account of the presence of lower oxides in the scale. In such cases there is danger that the ferric sulphate concentration may fall too low, especially in constricted regions such as between closely packed sheets, and it has been found advantageous to use higher ratios of ferric sulphate to hydrogen fluoride, sometimes as high as 10 to 1. On the other hand, if an oxidised scale is very thick and hard to remove, or if it is desired deliberately to etch the alloy, the ratio of ferric sulphate to hydrogen fluoride is kept low. In any case, if it is desired to increase the speed of descaling, both the over-all concentration and the temperature are increased.

Austenitic Steels

All the austenitic, 300-type stainless steels are being successfully pickled in this way on a practical commercial scale in ferric sulphate-hydrofluoric acid solutions. These include 18-8 (No. 302), 18-8 S (No. 304), 18-8 molybdenum (Nos. 316, 317), 18-8 titanium (Nos. 320, 321), 18-8 columbium (Nos. 345-348), 25-12 (No. 309), and 25-20 (No. 310). The more resistant chrome-nickel alloys such as 25-12 (No. 309 and 25-20 (No. 310) sometimes are better pickled under more drastic conditions, such as at higher temperatures, longer times, and even at higher concentrations with or without a sulphuric acid prepickle. Ferritic straight chrome steels containing no nickel do not, in general, pickle in the ferric sulphate-hydrofluoric acid solutions as satisfactorily as do the austenitic types. However, this problem is not hopeless and progress is being made.

Although the concentration of the ferric sulphate-hydrofluoric acid bath must be more accurately controlled than a nitric-hydrofluoric acid bath, this in reality works out to be an advantage since the former produces more uniform results than does the latter whose concentration and hence rate of attack may vary widely from hour to hour. The initial bath with ferric sulphate requires a little more care in preparation, since the dry granules of ferric sulphate are more readily dissolved in a hot solution. However, it is easier to make subsequent additions since the dry material or a concentrated solution made from it may be added directly to the tank while in operation.

On the basis of equal oxidising power, ferric sulphate is less expensive than nitric acid. In actual operation the chemical cost of using ferric sulphate-hydrofluoric acid baths is from 15 to 35 per cent. less than the nitric-hydrofluoric acid bath. And when it is considered that the high rate of attack of nitric acid consumes more metal and acid than necessary, the cost advantage for ferric sulphate is even greater.

For pickling copper alloys, ferric sulphate may be used in the descaling bath and in the brightening bath, or occasionally in a single bath which performs both functions. For descaling, ferric sulphate is added directly to the customary sulphuric acid prepickle. Of the heavy red and black scale on red brass (85 copper-15 zinc), under comparable conditions the sulphuric acid removes only the black part and leaves the alloy still red. On the other hand, the acid ferric sulphate bath removes both red and black scales, and leaves the metal clean and scale-free. A similar improvement is noted with alloys which have red patches of metal under the scale. A still further advantage of the acid ferric sulphate is observed in cases where the scale is uneven and a longer pickling time is required to remove the heavier portions. In this case when the lighter part of the scale is removed, the bare metal is exposed and in the plain sulphuric acid these portions of the alloy turn red. In the acid ferric sulphate, however, the red colour is not produced so that again a clean uniform surface is produced.

Solution for Copper Alloys

In pickling copper alloys neither the actual concentration nor the ratio of ferric sulphate to acid is critical. A solution containing initially 10 per cent. of sulphuric acid and 9 per cent. of ferric sulphate is satisfactory, although other proportions and concentrations are frequently used. Hot solutions for short times are the general rule, but both time and temperature may be adjusted to meet conditions. If the alloy contains beryllium or silicon, hydrofluoric acid is substituted for sulphuric and longer times are usually needed.

Although the surface produced by the acid ferric sulphate is clean and uniform, it does not usually possess a lustre. In cases where it is desired to brighten the clean alloy, it may be next dipped in a bath composed of ferric sulphate plus small amounts of certain organic acid addition agents. The surface of samples thus treated is smooth and shiny in contrast with that produced by treating a plain acid-prepickled sample in a regular bichromate bath just long enough to remove the red colour remaining after the sulphuric dip, when the surface was badly etched by the bichromate. The tendency of bichromate to etch is also encountered in brightening alloys with red areas on the metal, either caused by the acid or not removed by it. In these cases the surface apart from the red areas is often etched similarly by the time the red is removed. The roughness of the bichromate surface detracts from the appearance of the alloy and also increases the friction if the alloy is subsequently drawn. This not only wears the dies but leads to unnecessary breaking of the stock. It has been reported that alloys pickled in ferric sulphate draw better than those pickled in bichromate.

In a few cases the ferric ion baths so far tested have not duplicated the white colour resulting from the bichromate treatment but do result in a colour more natural to the alloy. The colour produced on any given alloy in the ferric sulphate addition agent bath may be controlled by selection of the proper addition agent and the temperature. For general use, to a 9 per cent. ferric sulphate solution is added either 0.1 per cent. cream of tartar, 3 per cent. acetic acid, 0.5 per cent. citric acid, or 0.5 per cent. glycolic acid. These are generally used cool, but in some cases a hot solution is preferable. For nickel silver, 0.5 per cent. adipic acid at room temperature is best, while for other alloys formic, lactic, or other organic acids are found suitable. The time varies from less than a minute to several minutes. Sometimes it has been found possible to use a single bath for both descaling and brightening. Such a bath would be 9 per cent. ferric sulphate plus 10 per cent. sulphuric acid and the addition agent.

During use it is sometimes found that a light and yellowish precipitate is formed. This may be prevented by keeping the *p*H below the point of precipitation by the presence of a few tenths per cent. of sulphuric acid. The *p*H of the precipitation point is often about 1.3. The precipitate is of no consequence to the pickling except that it uses up some of the ferric ion. Neither the concentration of ferric sulphate and agent nor their ratio to each other

is critical. The ferric sulphate is consumed during use and naturally should not be allowed to deplete itself too far. Although each addition agent does have a critical lower concentration limit below which it is not effective, they do not appear to be used up enough to require much replenishing. These baths are stable and do not lose their effectiveness on standing, as bichromate baths are frequently reported to do.

In those special cases where the technique of using ferric ion-agent baths has not yet been worked out and the bichromate finish is still desired, the danger of etching can be considerably reduced and a superior finish obtained by using the acid ferric sulphate prepickle in place of the regular sulphuric acid. All scale and surface blemishes are removed by the prepickle so that the alloy enters the bichromate in a clean uniform condition. The sole function of the bichromate under these conditions is to brighten; and if means exist for careful time control, the work may be removed after brightening but before etching.

Alloys which are satisfactorily pickled commercially in ferric sulphate baths include cartridge brass, high brass, leaded brass, low brass, red brass, rich low brass, commercial bronze, nickel aluminium bronze, phosphor bronze, silicon bronze, cupronickel, gilding metal, and nickel silver, as well as pure copper.

Other uses of ferric sulphate on metals at present include:

1. Etching of name plates, printing rolls, etc., by using a strong solution (20-25 per cent.).

2. Stripping an electropositive metal from a more electronegative one, such as nickel plate and tin plate from copper alloys, by 10 per cent. ferric sulphate plus 10 per cent. sulphuric acid.

3. Removing stains from welded areas on stainless steels. Regular ferric sulphate-hydrofluoric acid mixtures are applied by hand to the affected places.

4. Producing a clean and uniform surface on plain steel prior to drawing to obtain a smooth and even final finish.

The commercial use of ferric sulphate for metal treatment is relatively new. Consequently, its applications are far from having been fully explored.

Its position in the electromotive series determines its value as an oxidising agent and suggests its use in any application where this power is required.

Aluminium Specifications

New Edition of "Noral" Booklet

THE first edition of "Specifications for Aluminium and Aluminium Alloy Products," a fully classified summary of current D.T.D. and B.S. Specifications relating to aluminium and aluminium alloy products, was compiled by the technical staff of the Northern Aluminium Co., Ltd. Published in October, 1940, the booklet is now well known to all engaged in working to light alloy specifications. Since then many specifications have been cancelled or modified by the authorities and the new edition of the booklet includes all relevant alterations issued up to the end of November, the date "June, 1941" on the fly-leaf being that given on the latest of the official issues. With the object of simplifying the presentation of these changes, all specifications cancelled in recent years have been included in the numerical index of the new edition, with a note of the reason for cancellation given by the publishers.

A numerical list of the specifications is, as before, the basis of the index and is followed by the full range of British light alloys, classified according to the various forms in which each is produced. Under each heading are shown the appropriate D.T.D. and B.S. Specifications with the proprietary nomenclature and tables of chemical composition and mechanical properties. A tabulated summary of proprietary alloys in alphabetical order, showing the corresponding specifications and the forms of material to which they apply, is also given. Copies may be obtained free on application to the Research and Development Department of the Northern Aluminium Co., Ltd., Banbury, Oxfordshire.

U.S. Metallurgical Progress

Increased Zinc and Light Metal Production

THE U.S. Defense Plant Corporation has authorised the execution of a lease agreement with American Zinc Co., East St. Louis, Ill., to provide for an increase in zinc-producing facilities amounting to an estimated annual capacity of 17,000 tons of electrolytic slab zinc and 7200 tons of retort slab zinc. The same company will make additions to its plants in Monsanto and Fairmont City, Ill., providing for an increase of slab zinc production at these two plants of some 2000 tons per month. At the Monsanto plant the additions will provide for the production of electrolytic zinc and at Fairmont City for the preparation of ore, treatment of residues, retort slab zinc, metallic cadmium, and sulphuric acid.

Agreements with the Todd-California Shipbuilding Co. to lease new defence plants have also been announced. The firm gets an additional loan of $12,000,000 for construction of three magnesium metal plants. The Corporation has also authorised construction of a $22,000,000 aluminium fabricating plant at Fairview, Oregon, to be operated by the Aluminium Co. of America. A 128,000,000 lb. aluminium plant to be constructed in Arkansas will be located on Lake Catherine, near Malvern, Ark. Another loan was approved to the Permanente Corporation to enlarge magnesium production at Permanente, Calif. A high priority rating for necessary materials to ensure speedy construction of an aluminium plant at Massina, N.Y., has been granted by the Director of Priorities. The plant will have an annual production of 150,000,000 lb. of aluminium and will be operated by the Aluminium Co. of America. Meanwhile the Bohn Aluminium and Brass Corporation is authorised to proceed with the construction and equipment of two aluminium extrusion plants, one at Adrian, Mich., the other at Los Angeles, California. R. F. Evans, a director of the Diamond Alkali Co., and formerly vice-president in charge of research, has been named president of the Diamond Magnesium Co., a newly-formed subsidiary, which will operate the magnesium plant to be erected at Painesville, Oregon.

High Tensile Brass Bars

War Emergency Standard

WAR Emergency Specifications have been published by the British Standards Institution to provide for high tensile brass bars for forging and forgings which it was not found practicable to include in the recently revised B.S. 250. The specification covers two types of bars, one suitable for soldering and the other not suitable for soldering, and for the time being has been made the subject of a War Emergency Standard. It is hoped, however, that as a result of experience it may be possible to issue this Standard in the general series of specifications. Copies of these two new British Standards (B.S. 1001 and 1002) may be obtained from the Institution, 28 Victoria Street, London, S.W.1 (in one cover). Price 2s. 3d. post free.

MAGNETIC ALLOYS OF TO-DAY

New alloys for permanent magnets are about thirty times better than the best carbon steels used ten years ago, according to a report by William E. Ruder, head of the metallurgical and magnetic section of the General Electric Research Laboratory to the Institute of Radio Engineers at Rochester, N.Y. Part of the advance, he explained, has been achieved by heating the magnet material and then slowly cooling it in the field of a powerful magnet. The latest alloy "Alnico," generally consisting of iron, aluminium, nickel, and cobalt, was first proposed by a laboratory in Holland and developed by the General Electric Research Laboratory. The alloy may contain a small amount of copper as well. With magnetic cooling, its maximum energy is about five times greater than that of the best alloys used a few years ago.

Tin-Lead Alloy

Discovery of a Time-Softening Property

A CHARACTERISTIC, which, so far as is known, has never previously been associated with any alloy was observed about four years ago by Professor H. Vance White, head of the V.P.I. metallurgy department, in an alloy of tin in lead. Professor White discovered that this particular combination of metals exhibited the unique property of becoming softer with age. X-ray photography was applied by Miss Bertha H. Weaver, a graduate student in the V.P.I. physics department last session, to determine the internal changes accompanying this behaviour of the lead-tin alloy. Her findings are reported in a thesis entitled "X-Ray Investigation of the Time-Softening Property of a Lead-Tin Alloy" for which she has received the M.Sc. degree. The work was done under the direction of Professor Webster Richardson in the X-ray laboratory of the physics department and under Professor White in the metallurgy department laboratory. The results are considered so significant that the two departments plan to continue the investigation for the light it may throw on the whole theory of the ageing properties of alloys. The following brief summary of Miss Weaver's thesis was prepared by Professor Richardson.

It is well known that many alloys have a time-hardening property. An alloy which softens with time is not mentioned in literature. In this investigation the back-reflection powder method of crystal analysis was used to determine (1) whether or not the alloy was a solid solution of tin in lead; and (2) whether or not the softening was due to precipitation of tin from the alloy with time.

Measurement of Lattice Constants

The diffraction patterns clearly showed that the alloy was a solid solution of tin in lead. The lines were typical of a lead pattern, but showed an expansion of the lead lattice due to the substitution of a tin atom for a lead atom here and there in the lattice. The lattice constants for lead, tin, and the alloy were measured in the course of the investigation. The method of making such measurements is discussed in detail in the body of the thesis. The fact that tin is precipitated with time is proved by the appearance of tin lines in patterns of the alloy that had been allowed to stand for a few hours. The X-ray evidence is supported by conductivity tests which show evidence of precipitation with time.

The age-hardening properties of an alloy are explained by the so-called precipitation theory, which supposes that these properties are due to precipitation of the solute from the solvent. Miss Weaver points out that if this theory of age-hardening is to stand, it must be modified so as to explain softening as well. To quote from her thesis:

"The present theory, which postulates a keying action of particles precipitated between the crystal slip planes, could be adapted to the case by supposing that precipitation begins even while the metal is freezing and that the critical particle size for maximum hardness has already been surpassed by the time that solidification and quenching are complete. This offers no contradiction to the X-ray data which show no tin lines present within the first few hours, for lack of a line on the pattern simply means that the material was not present in sufficient concentration to produce its pattern. It does not mean that absolutely none of the substance is present."

In the course of the research a large number of diffraction patterns were made, employing the Debye-Scherrer cylindrical powder camera and a back-reflection camera built specially for use in the investigation. The thesis gives a singularly complete and clear discussion of the technique employed in making and interpreting X-ray diffraction patterns of metals and crystals in general.

A company to exploit manganese deposits in the neighbourhood of Talal, Chile, is to be formed, and the Corporation for the Stimulation of Production will subscribe 500,000 pesos towards the preliminary work.

Hot-Tinning Suggestions

The Treatment of Mild Steels

ENTITLED *Hot-Tinning "Difficult" Mild Steels*, Publication No. 107 of the Tin Research Institute, by W. E. Hoare, B.Sc., and H. Plummer, discusses difficulties encountered in hot-tinning certain mild steel articles and suggests means by which sound tin coatings may be obtained thereon. It is divided into three sections.

Section I outlines methods which may be employed in a tinning shop to avoid irregular and discontinuous coatings on articles and components fabricated from so-called "difficult" mild steels, and may be regarded as practical suggestions arising out of the scientific investigations described later in detail. *Section II* is a more detailed treatment of methods available for rectifying "difficult" steels. The procedures have their particular applications and, as modifications of technique may be necessary in certain cases, details of the experimental and theoretical basis for suggestions outlined in the first section may be found valuable.

Section III discusses the reasons why such "difficult" mild-steel surfaces arise in practice, and suggests means whereby the production of steels of inferior tinning quality may be avoided. The difficulties are ascribed to the formation of adherent lacquer-like films arising from the rolling and drawing lubricants and coolants being partially decomposed in contact with the metal surface by heat and possibly oxidation and pressure. These difficulties may be overcome by removing the contaminated surface by mechanical treatment, deep-etching, and anodic pickling, or by controlled heat-treatment. Methods of producing and fabricating mild steel of good tinning quality can be selected so that this trouble is avoided.

Mineral Wealth of Honduras

Mercury, Antimony, Manganese

MERCURY and other mineral deposits in Honduras are being actively investigated with a view to their exploitation. According to reports reaching THE CHEMICAL AGE, commercial quantities of quicksilver are reported to exist in the southern part of the country and the services of a Cuban geologist have been secured to examine likely occurrences. The development of another promising mercury-bearing property, near Jalapa, in Tegucigalpa, is also being considered.

Meanwhile a trial shipment of 25 long tons of antimony ore was sent to the United States (New York) from La Ceiba during the third quarter of 1941. The ore was mined in Olancho, near La Union. The antimony-bearing properties of the Yoro Mining Co. and the Honduras Antimony Co. have remained inactive during the past year, chiefly because of excessive transport costs between the deposits ant the ports.

Finally, it has been reported that manganese deposits near Ojojona, in Tegucigalpa, and Pespire, in Choluteca, are likewise capable of exploitation.

ELECTROLYTIC MANGANESE

Best results in the production of electrolytic manganese were attained by means of a sulphuric acid solution, using lead or a lead-tin-cobalt alloy as anode and chrome-steel or copper as cathode, in experiments with various electrolytes by R. Piontelli and collaborators, reported in *La Chimica e l'Industria*. A solution containing 200 g. $MnSO_4H_2O$, 100 g. ammonium sulphate, and 2 g. ammonia per litre as cathode solution, and 100 g. ammonium sulphate per litre as anode solution, gave a 52 per cent. yield with a current density of 500 amp./sq. metre (*I. and C.T.R.*, January 30, p. 104).

The Secretary for Mines has asked the newly-appointed Controller of Non-Ferrous Mineral Development to investigate and report on tin-mining in Cornwall as a matter of urgency, and the question of the assistance to be given will be considered in the light of that report.

Personal Notes

MR. THOMAS TAYLOR has succeeded the late Mr. S. Rawson on the executive committee of the Chemical and Allied Trades Section, Manchester Chamber of Commerce.

Obituary

MR. A. F. CATHARINE, who died on January 23, was manager of the publicity department of Worthington-Simpson, Ltd., Newark, Notts. He has been for more than 45 years in the service of the company.

MR. MICHAEL C. DUNSMORE, who died at Stirling on January 27, aged 69, was chief engineer of the Tharsis Sulphur and Copper Co., Ltd., Glasgow. Recognised as a highly competent engineer, he carried out important work for the company both in this country and in Spain.

MR. HENRY SUTTON TIMMIS, who died in Liverpool on January 25, was a director of William Gossage and Sons, soapmakers, Widnes, as his father had been before him. He was the last surviving member of the original Town Council of Widnes, having served from the incorporation of the borough in 1892 until his resignation 30 years later.

Chemical Matters in Parliament

Refining of Used Lubricating Oil

IN the House of Commons last week, Sir Irving Albery asked the Secretary for Petroleum how much used lubricating oil was salved for further use during the last three months of 1941, or during any other convenient period; and by what process.

Mr. Geoffrey Lloyd said that various refinery plants for the treatment of used lubricating oil were in operation and others in course of erection. In addition a large number of lubricating-oil consumers filtered their used oil for further use. In this way large quantities of lubricating oil were re-used, but owing to the fact that much of the recovery of used oil was effected within the consumers' works, figures of quantities treated for re-use were not available. In answer to a supplementary question, Mr. Lloyd emphasised the fact that by "re-used" he did not necessarily mean lubricating oil only, but oil used also as fuel oil. He added that the salvaging of this oil was being undertaken on a large scale.

Aneurin in Flour

Sir E. Graham-Little asked the Parliamentary Secretary to the Ministry of Food what chemicals were added to Canadian or other imported flour before export and what were the proportions of each such added ingredient; and whether the flour was chemically bleached either before or after arrival.

In reply, Major Lloyd George stated that the only substance added to Canadian flour before export, under instructions from the Ministry of Food, was aneurin (synthetic vitamin B1), which is added to bring the B1 content to a figure similar to that of fortified flour produced in this country. The position in regard to chemical improvers and bleachers in Canadian and other imported flour was understood to be similar to that of flour milled in the United Kingdom, but no information was available as to the proportion of any added ingredient in individual consignments. Imported flour was not chemically bleached after arrival in this country.

A Production General Staff

The question was raised, by Mr. Graham White, of the advisability of establishing a production general staff, consisting of production engineers and other technologists, charged with the duty of continuous experiment and research in methods of production, and enjoying sufficient authority to see that the best known methods and improvements were adopted by all production departments.

Suggestions for making better use of research and technical experience always received consideration, replied Mr. Attlee, but production for war purposes required so many different processes that it would not be practicable to set up a single body with the suggested functions. Experiments and research towards improvement of production methods were constantly being carried out, and means existed for the interchange of information so obtained. The production Ministries also had ready access to the best independent scientific experience, which was always most generously given.

Non-Ferrous Metal Control

Mr. Stokes asked the Parliamentary Secretary to the Ministry of Supply what changes had been made in the non-ferrous metal control; and whether he would give the names of the controllers and the amount paid to them. Replying, Mr. Harold Macmillan stated that the Non-Ferrous Metal Control had recently been extended to deal with a number of additional metals, including tin, antimony, cadmium, manganese, and nickel, and also to supervise die-casting capacity. The Joint Controllers of Non-Ferrous Metals were Mr. J. C. Budd and Mr. William Mure, whose remuneration was included in the fee paid to the British Metal Corporation for operating the Control.

Scrap Rubber

Mr. Parker asked the Parliamentary Secretary to the Ministry of Supply what he intended to do with the quantities of scrap rubber which the scrap rubber salvage campaign had as its object, in view of the fact that there was not sufficient reclaiming plant in the country to deal with the scrap readily accessible. In reply, Mr. Harold Macmillan said that reclaiming plant in this country was being extended, and provision was being made for storing for the future such accumulations as could not be used as they were collected.

Answering a further question as to whether he was aware that the Ministry of Home Security had stressed the undesirability of large stocks of scrap rubber, and had taken effective steps, in some instances, to have them dispersed; and whether his Ministry was carrying out the same policy, Mr. Macmillan replied in the affirmative.

Chemical Control Board

In reply to questions by Mr. Liddall, the Parliamentary Secretary to the Ministry of Supply outlined the constitution of the Chemical Control Board, as follows: a full-time chairman (Mr. F. W. Bain), with a staff of four, a secretary (Mr. W. A. M. Edwards), serving also as principal of staff, and the Controllers of the following raw materials Controls: Fertilisers; Industrial Ammonia; Miscellaneous Chemicals; Molasses and Industrial Alcohol; Plastics; and Sulphuric Acid. The Plastics Control was administered by a Controller, a Deputy-Controller and an Assistant Controller (all officials of the plastics industry, serving without remuneration), three senior officers and a clerical staff of fifteen.

New Control Orders

Molasses and Industrial Alcohol

THE Minister of Supply has made the Control of Molasses and Industrial Alcohol (No. 14) Order, which came into force on February 4. This Order controls paraformaldehyde (Paraform) and metaformaldehyde or hexamethylene tetramine (hexamine, hexine, urotropine). Licences are necessary for the acquisition or disposal of quantities of these materials greater than 1 cwt. in 6 months. Applications for licences should be addressed to the Molasses and Industrial Alcohol Control, Epsom.

The mining schools of the Ecole Polytechnique and Université Laval in Quebec are described in the current issue of Deco Trefoil, the publication of the DENVER EQUIPMENT CO., LTD., 493a Northolt Road, South Harrow, Middlesex. Although the interest of the average French-Canadian engineer in mining is comparatively recent, comprehensive courses are now being undertaken at both these universities. Lectures are conducted in French at the Ecole Polytechnique, but English textbooks are used, so that graduates are bilingual.

General News——From Week to Week

Four 25 lb. drums of essential oil of lemon, valued at about £150, were stolen in London last Tuesday.

In the January examinations eleven candidates passed the Examination in General Chemistry for the Associateship of the Institute of Chemistry.

A consultative body to be known as the Rayon Council, to co-ordinate the rayon industry, has been set up. Sir Percy Ashley, recently Cotton Controller, is chairman.

Imports into Australia of chemicals, including dyes, in the September quarter of 1941, totalled £1,753,109 against £1,559,908 in the corresponding period of 1940.

We are grateful to the Denver Equipment Co., Ltd., of Denver, Colarado and S. Harrow, Middlesex, for their usual very useful wall calendar for 1942, showing the whole 12 months at a glance, which we received from America this week.

A move to expand tin production in Cornwall, it is understood, by the supply of further expert labour, is being made by the Ministry of Supply, but the new labour will be confined to the three principal mines—South Crofty, East Pool and Agar, and Geevor.

The Institute of the Plastics Industry, at its 10th annual meeting, retained, by unanimous request, all officers and members of Council for a further year. Mr. Kenneth M. Chance, therefore, remains as president, and Mr. R. P. Cartwright as chairman of council.

Experiments with insecticides announced by the Imperial Forestry Institute in their 17th annual report (1940-41) include the successful use of naphthalene against chafer larvæ in forest nurseries and of calcium arsenate in controlling pine weevil. Further progress was made in the study of *p*-dichlorobenzene as a larvicide.

Returns of disused machinery and scrap metal at manufacturers' premises of all kinds can now be called for by the Ministry of Works. There is no intention to take valuable machinery which must be preserved for use after the war, and that of firms closed by concentration schemes will not be requisitioned.

In connection with explosions in grinding plants, the Seed, Oil, Cake, and General Produce Association has been invited by H.M. Chief Inspector of Factories to take part in a conference to be held in London. It was decided that certain experimental work should be undertaken, and a special committee has been set up for the purpose of carrying out the investigation.

The Secretary for Petroleum has issued a General Licence (S. R. & O. 1941, No. 2127), regulating the purchase of "industrial spirits" (benzole—other than motor benzole—special boiling-point spirits, white spirit, and rubber solvent), and has made a Direction (S. R. & O. 1941, No. 2128), which prohibits the use in internal combustion engines of any "industrial" spirits covered by the licence and obtained without the surrender of ration coupons.

The Poisons (Amendment) Rules, 1942 (S.R. & O. 1942, No. 155), made on January 13, provide for the inclusion of surgical spirit (in which a small quantity of brucine has been substituted for diethyl phthalate) in Group II of the 3rd Schedule to the Poisons Rules, 1935, thereby exempting the new formula from the restrictions governing the sale of brucine. The sale of this surgical spirit will, however, remain subject to the Methylated Spirits Regulations, 1930, which require surgical spirit to be labelled "for external use only—not to be taken." The general restrictions which apply to brucine as a poison included in Part I of the Poisons List are not otherwise affected.

Foreign News

The classified list of Smithsonian Publications available for distribution, December 1, 1941, is now obtainable from the Smithsonian Institution, Washington. In the chemical section the bibliography of the platinum metals, and the indexes to the literature of certain other rare metals would appear most useful.

Recovery of copper from vine leaves sprayed with copper sulphate has been attempted in Italy. The leaves, when burnt, left traces of copper among the ashes equivalent to 5 lb. of metallic copper per acre.

Regulations for the control of iron and steel in various forms, paper, lubricating oils, rubber, pneumatic tyres, tubes and tins are announced from Cape Town. They apply to South-west Africa as well as to the Union.

Mercury production in the U.S.A. during October is reported to have been 4000 flasks, while consumption increased to 4800 flasks, which is possibly the highest figure ever reached in America. Nominal prices were $193-5 a flask at the beginning of the month, rising at the end to $195-7.

Phosphates Tunisiens had to reduce shipments in 1940/41 to 72,000 tons, as compared with 174,000 tons in 1939/40, the fertiliser factories in France having suffered from a shortage of electric power. The Yugoslavian subsidiary, La Dalmatienne, discontinued operations in May last.

Apatite waste from local iron mines is the raw material used by superphosphate manufacturers in Sweden, since imports of phosphorite and apatite have ceased owing to the war. The production will be sufficient to meet the demand, which has been reduced to 160,000 tons per annum.

A factory for the production of tanning extracts from oak wood and spruce bark is to be built by the Association of Danish Leather Manufacturers. It will produce 1200-1500 tons annually, about half the country's requirements. An operating company has been formed, with a capital of 600,000 kroner.

The recovery of zinc from blast-furnace slag is being actively pursued in Australia. Sir Colin Fraser, speaking at the annual meeting of Broken Hill South, Ltd., referred to a large slag-heap at Port Pirie, which contained 15.78 per cent. of zinc, as well as lesser quantities of lead and silver. Research work to improve the process was likewise in hand.

The Belgian Central Office for Fuel Production intends to market a standard fuel made by blending gas oil with an equal quantity of other fuel materials. The organisation is also to help in providing raw material for hydrogenation. About 2000 tons of coal residues yield 500-600 tons of coal for the production of synthetic oil.

Owing to the increased demand for chrome in war time, the U.S.A. is reported to be prepared to buy 100,000 tons of this mineral from Brazil yearly. Deposits of chrome in the State of Bahia are estimated at 4,000,000 tons, but, owing to transport difficulties, exports so far have been very small, totalling in 1904 only 4572 tons; 1941 exports are expected to be on the same level.

The combined aluminium output of the United States, Britain, and Canada is expected to be nearly doubled by the end of 1942, states Mr. C. W. Wright, a minerologist, quoted by the U.S. Bureau of Mines on January 18. His report also expressed confidence that by 1943 Anglo-American output of magnesium would be more than four times Germany's 1941 production, according to a Reuter message from Washington.

Under the style of A/S Nordag, a company has been formed in Oslo, with a share capital of 700 million kroner, for the production of light metals, particularly aluminium. Half the capital has been paid up and the other half will be paid within two years. It is believed in Scandinavian circles that the new enterprise has been constituted under the auspices of the I.G. Farben and Norsk Hydro, and that it will produce chiefly aluminium oxide.

Copper in important quantities is likely to be produced by Mount Isa Mines, Ltd., the large lead-zinc concern, situated west of Cloncurry, North Queensland. It has been reported that the Commonwealth Government is advancing £50,000 to the company to enable it to develop the occurrences of copper ore on its property and to place it in a position to starting these operations this year. The output is expected to be 5000 tons per annum.

Forthcoming Events

Professor D. M. Newitt will lecture on "High Pressure Reactions and Technique" before the Leeds Area Section of the **Institute of Chemistry** on **February 9**, at 6.30 p.m., in the Chemistry Theatre, Leeds, College of Technology.

The next London meeting of the **Electrodepositors' Technical Society** will take place at the Northampton Polytechnic, St. John Street, Clerkenwell, E.C.1, on **February 9**, at 4 p.m., when a paper on "Current Distribution on Interior Surfaces" will be presented by Dr. J. Kronsbein.

A joint meeting of the **Institution of Chemical Engineers** and the **Chemical Engineering Group** (S.C.I.) will be held on **February 10**, at 2.30 p.m., in the Geological Society's rooms, Burlington House, Piccadilly, W.1, when a paper on "Design and Performance of Cooling Towers" will be presented by Mr. W. K. Hutchison and Dr. E. Spivey.

The annual meeting of the Colour Group of the **Physical Society** will be held in the Physics Department of the Imperial College, London, S.W.7, on **February 11**, at 2.30 p.m. Afterwards Dr. W. D. Wright will give an address on "Research on Colour Physics at the Imperial College."

A domestic meeting of the Nutrition Panel of the **Society of Chemical Industry** will be held on **February 11**, at 2.15 p.m., at Burlington House, Piccadilly, when Dr. N. W. Pirie, Dr. T. Moore, and others will speak on "Green Leaves as a Source of Protein and Other Nutrients."

The India and Burma Section of the **Royal Society of Arts**, John Adam Street, Adelphi, London, W.C.2, will meet on **February 13**, at 1.45 p.m., to hear an illustrated lecture by Mr. A. J. Gibson entitled "The Story of Lac."

A joint meeting of the South Yorkshire Section of the **Institute of Chemistry** with the **Sheffield Metallurgical Association** will be held on **February 14** at 3 p.m. at 198 West Street, Sheffield 1, when Mr. E. J. Vaughan and Lieut. J. Convey will deliver a paper on "Further Advances in Metallurgical Analysis."

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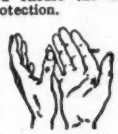

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Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur..

Notice of Intended Dividend

CADMIUM PLATING CO., LTD., 64 John Street, Sheffield. Court, Sheffield. Last day for receiving proofs, February 11. Liquidator, E. R. Harrison, 11 York Street, Sheffield.

Satisfaction

LEVER BROTHERS AND UNILEVER, LTD., London, E.C. (M.S., 7/2/42).—Satisfactions January 15, of debenture stock registered May 4, 1932, to the extent of £68,800, and of debenture stock registered November 1, 1932, to the extent of £45,763.

Company News

A. Boake Roberts and Co., Ltd., report an interim dividend of 1½ per cent., tax free (same).

Super Oil Seals and Gaskets, Ltd., announce a final dividend of 25 per cent. (same).

Thorncliffe Coal Distillation, Ltd., report an interim dividend of 25 per cent., less tax (same).

Amalgamated Anthracite Collieries, Ltd., announce that the dividend on the 3½ per cent. cumulative preference stock, due on April 1, will not be paid.

Fison, Packard and Prentice, Ltd., announce net trading profits for the year to June 30 of £352,823 (£423,937), and have declared a final dividend of 7½ per cent., making 10 per cent. for the year (same).

The Anglo-Chilean Nitrate Corporation announce that distributable profits for the year ended June 30 last, amount to £373,224 (£664,006). Interest of 4½ per cent (same) is being paid on the sterling first mortgage income debentures and on dollar sinking fund debentures.

Caribonum Trust, Ltd., announce net income for year ended January 31 of £46,746 (£54,487), and have declared a final dividend of 8 per cent., making 11 per cent. for the year (same). Profits of the subsidiary company, **Caribonum, Ltd.,** for 1941, amounted to £103,683 (£126,652).

Chemical and Allied Stocks and Shares

STOCK EXCHANGE markets have been dull and inactive. There was again little selling reported, and most movements in values were small. In accordance with the general trend, British Funds were less active, but they maintained a steady undertone. Movements in many leading industrial shares did not exceed more than a few pence, while on the other hand, quotations for numerous smaller-priced shares did not appear to be tested by business.

A fairly steady tendency was shown in securities of companies associated with the chemical and kindred industries. Imperial Chemical at 32s. 9d. were within 3d. of the price ruling a week ago, the market having continued to budget for the maintenance of the dividend at 8 per cent. Moreover, I.C.I. 7 per cent. preference remained at 35s. There was an easier tendency in Lever and Unilever at 29s. 9d., but the preference shares were unchanged, the 8 per cent. being 29s., while the 20 per cent. 5s. preferred ordinary were 16s. 3d. A number of dealings were reported in Borax Consolidated deferred, which at 30s. 6d. were unchanged, awaiting the impending dividend announcement. Fison Packard remained firm and at one time changed hands up to 39s. B. Laporte were again 63s. 9d. British Drug Houses continued to show rather more dealings and have transferred at 26s. 3d., while the 5 per cent. preference changed hands at 20s. 6d.

Activity again ruled in British Plaster Board 5s. shares, which, however, were 6d. lower on balance at 21s. 6d. Associated Cement eased to 53s. 1½d., but in other directions Wall Paper Manufacturers deferred units improved slightly to 27s., and Nairn and Greenwich were a few pence higher at 58s. 1½d. Hopes that a satisfactory impression will be created by results for the past year's working have maintained steadiness in British Oxygen and British Aluminium at 68s. 1½d. and 45s. respectively. Small fluctuations were shown in United Molasses, which at 31s. 10½d. were little changed on balance, while the units of the Distillers Co. were 74s. 3d., but were less active. The market remains hopeful that the two last-named companies will be able to maintain dividend payments. British Tyre and Rubber shares have continued firm under the influence of the maintained payment, but Dunlop Rubber were lower on balance at 29s., the general assumption being that the last-named company will reduce its distribution in view of its interests in Malaya. Relatively steady features were provided by Turner and Newall at 71s. 3d., and by Murex at 57s. 6d. Awaiting the results, due in March, United Glass Bottle shares remained firm at 56s., although it is realised that, despite the strong balance-sheet, the directors will probably continue to deal very conservatively with profits and again limit the dividend to 12 per cent. Canning Town Glass 5s. shares were again quoted around par; results of this company are also due in a few weeks. There was a fair amount of activity in Triplex Glass 10s. units, which were quoted at around 33s. Morgan Crucible first and second preference units have continued to maintain their recent improvement, while Monsanto Chemicals 5½ per cent. preference were 22s. 6d. Business at 26s. 9d. was shown in Sanitas 9 per cent. preference, and elsewhere, W. J. Bush 4 per cent. debentures at one time transferred at 94.

In other directions, British Thermostat shares changed hands between 13s. 6d. and 15s. British Glues and Chemicals 4s. shares were again firm around 6s. 6d. Greeff-Chemicals 5s. units were around 5s. 6d. There was a fair amount of activity in British Industrial Plastics 2s. shares, which were quoted at 3s. 4½d. Fewer dealings were reported in Erinoid 5s. ordinary, which, however, were around 8s.. Only small movements were shown in iron and steel issues. Tube Investments were 85s. 9d., Staveley 44s. 10½d.; United Steel 22s. 6d., and Dorman Long 20s. 3d. Elsewhere, Imperial Smelting were inactive and unchanged at 10s. 6d., but General Refractories eased slightly to 9s. 10½d. International Paint shares held their recent rise to 95s. awaiting the dividend announcement. Boots Drug were 36s. 6d. Oil shares have been reactionary with sharp declines in Burmah Oil and "Shell." Anglo-Iranian were relatively steady.

British Chemical Prices

Market Reports

BUSINESS in general chemicals during the past week has been moderately active, dealers being chiefly occupied with contract deliveries. Almost without exception values are steady with a firm undertone and this is particularly emphasised in the potash and soda products sections. Supplies of several products remain tight, amongst which may be named chlorate of soda, yellow prussiate of soda, yellow prussiate of potash and oxalic acid. White acetate of lead is in good demand and the lead oxides continue firm at unchanged rates. Business in the coal tar products section has been quiet and with the exception of carbolic acid crystals and crude carbolic movements have been on a moderate scale. Information regarding the control scheme for cresylic acid is still awaited by the market and in the meantime business in this section is mainly confined to contract deliveries.

MANCHESTER.—A fair flow of new inquiry has been reported on the Manchester chemical market during the past week and moderate additions to order-books have been made. These cover a rather wide range and include the leading soda compounds, the acid products, and other industrial chemicals. The call for supplies under contracts during the week has been on steady lines. Price conditions throughout have been extremely firm. In most instances good quantities of the tar products have been absorbed, though the naphthas and xylols have continued rather quieter.

GLASGOW.—In the Scottish heavy chemical trade business has been very quiet during the past week both for the home market and for export. Prices remain extremely firm.

Price Changes

Soda, Caustic.—Solid, 76/77%; spot, £16 7s. 6d. per ton, d/d station.

Sodium Percarbonate.—21½% available oxygen, £7 per cwt.

The Institute of Physics is arranging a conference on "X-Ray Analysis in Industry," to be held in Cambridge on April 10 and 11. The purpose of the conference is to promote the interchange of knowledge and experience between those employing X-ray analysis (diffraction methods) in their work in different fields and to arrange for further collaboration between physicists, engineers, chemists, and others towards the solution of problems by its methods. During the conference Sir Lawrence Bragg will lecture on "The History and Development of X-Ray Analysis." Further particulars can be obtained from the Secretary of the Institute at The University, Reading, Berks., to whom application for accommodation in Cambridge should be made before **February 14.**

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